Remarks:

Reconsideration of the application is requested.

Claims 1 and 3-11 remain in the application. Claim 1 has been amended.

In item 2 on page 2 of the above-identified Office action, the specification has been objected to for containing no indication what value should be selected for the charge q_c appearing in claim 1 and for containing contradictory information concerning the quantities ρ and q.

In item 4 on pages 4-5 of the above-identified Office action, claims 1 and 3-11 have been rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

More specifically, the Examiner has stated that the critical charge density is not linked to an electric field applied between the first and second electrodes by Poisson's equation, unless charge distribution is provided as well.

The specification and the claims have been amended to even more clearly define the invention of the instant application.

The integral over the z-direction of $\rho(z)$ relates to the integral over the layer thickness of the semiconductor body (see the second paragraph on page 14 of the specification). This means that the charge density of the layer thickness in the direction z will be integrated, namely the space charge density of individual layers over the entire thickness, which necessarily results in the charge Q.

In the enclosed "Explanation sheet", a layer with a space charge ρ in this layer is shown in Fig. 1. The space charge ρ indicates how much charge is contained in a layer having a thickness ΔW. When this space charge ρ is integrated over the thickness W, the charge Q will inevitably result from the integral for the space charge ρ.

It is accordingly believed that the specification and the claims meet the requirements of 35 U.S.C. § 112, first paragraph. Should the Examiner find any further objectionable items, counsel would appreciate a telephone call during which the matter may be resolved. The above-noted changes to the claims are provided solely for cosmetic and/or clarificatory reasons. The changes are neither provided for overcoming the prior art nor do they narrow the scope of the claims for any reason related to the statutory requirements for a patent.

In view of the foregoing, reconsideration and allowance of claims 1 and 3-11 are solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate a telephone call so that, if possible, patentable language can be worked out. In the alternative, the entry of the amendment is requested as it is believed to place the application in better condition for appeal, without requiring extension of the field of search.

Please charge any fees which might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner and Greenberg, P.A., No. 12-1099.

Respectfully submitted,

For Applicants

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Marked-Up Version of the Amended Paragraphs in the Specification and Marked-Up Version of the Amended Claims:

The paragraph starting on page 2, line 22 and ending on page 3, line 15 now reads:

A power semiconductor component receives the voltage applied to it through mutual depletion of neighboring p- and n-conductive regions by mobile charge carriers, so as to create a space charge zone. In an n-channel power MOS field-effect transistor, spatially fixed charges created in a p-conductive well hence find their "mirror charges" primarily in a vertically adjacent n-conductive layer, which is normally produced by epitaxy. The maximum of the electric field always occurs at the pn junction between the p-conductive well and the semiconductor body. Electrical breakdown is reached when the electric field exceeds a material-specific critical field strength E_c: this is because multiplication effects then lead to the creation of free charge carrier pairs, so that the blocking-state current suddenly increases greatly. But since, as is known, charges are the sources of any electric field, this critical field strength E_c can be assigned an equivalent <u>critical</u> breakdown surface charge Q_c according to the first Maxwell equation. For silicon, for example, $E_c = 2.0 \ldots 3.0 \times 10^5$ V/cm and $Q_c = 1.3 - 1.9 \times 10^{12}$ charge carriers cm^{-2}. <u>Since each charge carrier has the charge of e (electronic charge =</u>

1.6 x 10^{-19} As), Q_c can take values from 2.08 - 3.04 x 10^{-7} As.cm^{-2}. The exact value of Q_c depends in this case on the level of the doping.

The paragraph starting on page 14, line 17 and ending on page 15, line 4 now reads:

In accordance with an added feature of the invention, the layer thickness of the semiconductor body has a specific charge density ρ in a direction z between the pn junction and the second main surface such that:

$$\int_0^W \rho(z)dz \le 0.9[q_c]\underline{Q_c}$$

in which [q_c] Q_c, the critical breakdown surface charge denotes a critical value of the breakdown surface charge [quantity q in said semiconductor body] Q at which the electrical breakdown is reached, said [change] charge quantity [q] Q being linked to said electric field strength E between said first electrode and said second electrode by the above equation

$\int_0^W \rho(z)dz \le [q]\underline{Q}$ and Poisson's equation $\nabla E = -4\pi\rho$.

The paragraph starting on page 20, line 4 and ending on page 20, line 23 now reads:

The critical value E_c of the field strength is linked to a charge density ρ by [the Maxwell] Poisson's equation

$$\bar{\nabla}.\bar{E} = -4\pi\rho, \qquad (1)$$

so that a relationship with a critical breakdown surface charge [q_c] Q_c can be derived:

$$[\int_0^W \rho(z)dz = q_c.] \quad \int_0^{W_{SC}} \rho(z)dz = Q_c. \qquad (2)$$

W_{SC} denotes the width of the space charge region (i.e. the region with $|\bar{E}| \neq 0$) when the electric field reaches the critical field strength E_c. According to the invention, the layer thickness W should then be selected in such a way that the space charge zone reaches the second main surface 3 before the field strength takes on the critical value E_c. In this case, the integration in following equation (3) has to be carried out over the entire layer thickness W of the semiconductor body 1 between the pn-junction between the semiconductor body 1 and the body zone 4 and the second semiconductor surface 3. In other words, the integral in Equation (2) should, for example, reach at most the value 0.9

[q_c] $\underline{Q_c}$ so that, in the vertically structured power semiconductor component according to the invention, the following equation is satisfied:

$$\int_0^W \rho(z)dz \leq 0.9[q_c]\underline{Q_c}\,. \qquad (3)$$

The paragraph starting on page 22, line 6 and ending on page 22, line 16 now reads:

Each of the two charge areas or "columns" must contain only a fraction of the <u>critical</u> breakdown surface charge, seen in the horizontal direction, so that the horizontal surface charge is smaller than the critical <u>breakdown surface</u> charge [q_c] $\underline{Q_c}$. In the blocking case, the voltage is received by the power semiconductor component through mutual depletion of neighboring p-conductive and n-conductive areas. In other words, the charge carriers of one area electrically "compensate" for those of the oppositely charged area. In the individual planes, at low voltages, this leads to an electric field which is primarily directed horizontally.

Claim 1(amended). A vertically structured power semiconductor component, comprising:

a semiconductor body of a first conductivity type and having a first main surface and a second main surface opposite said first main surface;

a body zone of a second conductivity type opposite of said first conductivity type introduced into said first main surface;

a zone of said first conductivity type disposed in said body zone;

a first electrode making contact with said zone and with said body zone;

a second electrode disposed on said second main surface;

an insulating layer disposed on said first main surface;

a gate electrode disposed above said body zone and separated from said body zone by said insulating layer; and

an intersection of said semiconductor body and said body zone defining a pn junction;

said semiconductor body having:

a layer thickness between said pn junction and said second main surface selected such that, when one of a maximum allowed blocking voltage and a voltage just less than this, is applied between said first electrode and said second electrode, a space charge zone created in said semiconductor body meets said second main surface before a field strength E created by an applied blocking voltage reaches a critical value E_c at which an electrical breakdown is reached; and

a specific charge density ρ(z) of a layer in a direction z between said pn junction and said second main surface such that:

$$\int_0^W \rho(z)dz \leq 0.9[q_c]\underline{Q_c}$$

in which [q_c] $\underline{Q_c}$, the critical breakdown surface charge denotes a critical value of the breakdown surface charge [quantity q in said semiconductor body] Q at which the electrical breakdown is reached, said [change] charge quantity [q] Q being linked to said electric field strength E between said first electrode and said second electrode by the above equation

$$\int_0^W \rho(z)dz \leq [q]\underline{Q}$$ and Poisson's equation $\nabla E = -4\pi\rho$.

Explanation sheet

Fig. 1

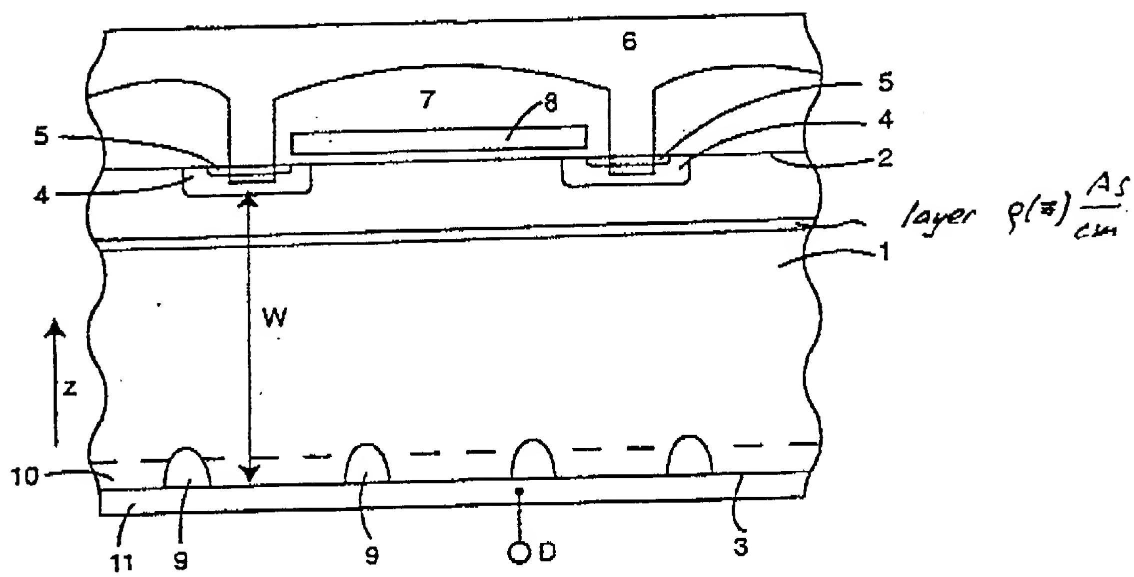

Fig. 2